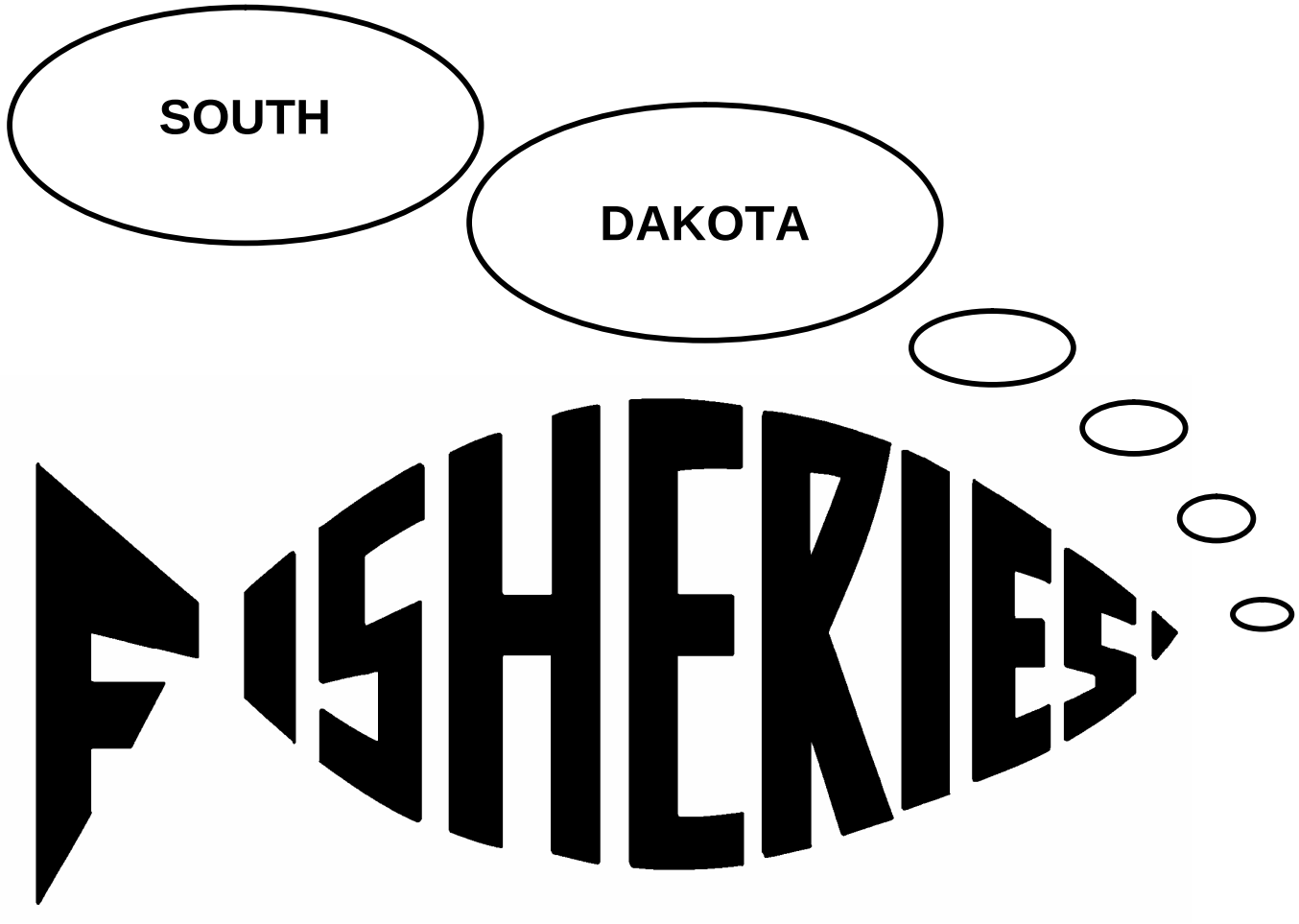

REGION III SMALL IMPOUNDMENTS STRATEGIC PLAN 2004-2009

South Dakota
Department of
Game, Fish and Parks
Wildlife Division
Joe Foss Building
Pierre, South Dakota 57501-3182

Progress Report
No. 04-13

Region III Small Impoundments Strategic Plan, 2004-2009

by

David O. Lucchesi, Todd R. St. Sauver, Bruce A. Johnson and Kevin A. Hoffmann
South Dakota Department of Game, Fish and Parks

and

David W. Willis
Department of Wildlife and Fisheries Sciences
South Dakota State University

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Preface

Copies of this report and reference to the data can be made with written permission of the author or the Director of the Division of Wildlife, South Dakota Department of Game, Fish and Parks, Foss Building, Pierre, South Dakota, 57501.
We would like to thank Dr. Steve Chipps for reviewing the plan.

Introduction

The South Dakota Game, Fish and Parks (SDGFP) Region III fisheries staff manages 19 small impoundments across southeastern South Dakota (Table 1). Small impoundments, as defined by SDGFP, are impounded waters less than 150 acres. Oxbow lakes, McCook and Burbank, and city recreation lake, Covell Lake, are not impoundments, but were included in the strategic plan because of their similarity to other small impoundments. Although larger than 150 acres, Carthage (203 acres) and McCook (274 acres) lakes, were included in this category for the same reason.

Although small impoundments comprise only about 1,600 acres of water in Region III, they are important fisheries and often receive heavy use. For example, creel surveys have shown that Lake Alvin annually supports over 100 hours of fishing per acre of water, whereas popular large lakes like Madison or Thompson commonly support only 10-30 hours per acre. Fishing pressure on central South Dakota small impoundments has varied greatly from minimal use to 144 h/acre depending on the quality of fishing (Neumann et al. 1993; Blackwell 1998, 1999, 2000). Good shore fishing access, a lack of other nearby fishing opportunities and proximity to population centers often make small impoundments popular places to fish.

Table 1. List of small impoundments whose fisheries are managed by the South Dakota Game, Fish and Parks.

Lake	Acres	County	Primary fish species[1]
Alvin	90	Lincoln	LMB, BLG, BLC, WHC, CFC
Burbank	100	Clay	LMB, BLG, BLC
Carthage	203	Miner	LMB, WAE, BLG, BLC, CFC, BLB
Covell	15	Minnehaha	NOP, YEP, BLB, RBT
Dimock	75	Hutchinson	LMB, BLC, BLG, CFC
Ethan	27	Hanson	LMB, NOP, WHC
Hanson	55	Hanson	LMB, WAE, BLG, BLC, WHC
Henry	160	Bon Homme	LMB, YEP, BLC, BLG, CFC
Iroquois	40	Kingsbury	NOP, YEP
Lakota	100	Lincoln	LMB, BLG, CFC
Marindahl	139	Yankton	LMB, BLG, BLC, CFC
McCook	274	Union	LMB, BLC, CFC
Menno	47	Hutchinson	LMB, BLG, BLC, CFC, BLB
Patton	5	Aurora	RBT
Ravine	83	Beadle	WAE, NOP, WHC, CFC, BLB
Staum	40	Beadle	LMB, BLG, BLB
Stoney Run	57	Beadle	
Tripp	10	Hutchinson	LMB, BLG, CFC
Wilmarth	103	Aurora	LMB, BLG, BLC, BLB

[1]Abbreviations for fish species are as follows: BLB, black bullhead; BLC, black crappie; BLG, bluegill; CFC, channel catfish; LMB, largemouth bass; NOP, northern pike; RBT, rainbow trout; WAE, walleye; WHC, white crappie; and YEP, yellow perch.

Providing quality fish communities in many of these small impoundments is difficult. Degraded habitat, low productivity, winterkill, and watershed problems hinder management efforts. These problems often result in fish communities comprised of low numbers of gamefish and high numbers of small panfish and rough fish that are of little interest to anglers.

Better fish communities in our small impoundments would result in a substantial increase in angler use and satisfaction. A variety of fish management practices are currently being employed to increase predator abundance, improve panfish size and reduce rough fish abundance. However, maintaining quality fish communities over the long term would be less difficult if water quality and aquatic habitat issues could be addressed.

The objectives for this strategic plan are to identify and prioritize problems and issues, summarize existing data and develop a current inventory, establish measurable goals and objectives for improving small impoundment fisheries and outline potential strategies that will allow us to meet those goals and objectives.

Issues

In 1994, the Small Lakes and Ponds Strategic Planning Committee grouped issues with small waters into four categories: loss of resource, access to resource, fish management and information and education (SDGFP 1994). In an exercise done in winter 2003-04, SDGFP Region III fisheries staff and Dr. Willis (South Dakota State University, Wildlife and Fisheries Department) identified issues or problems with Region III small impoundments (Table 2). Participants in this process individually assigned issues/problems to small impoundments where they considered them applicable. Responses were compiled to create the following matrix (Table 2).

Large-scale watershed problems and associated habitat degradation were the most commonly cited small impoundment issues (Table 2). Many of the state's small impoundments have been impacted by moderate to severe siltation (Wilson 2002). Turbidity from silt-laden inflows inhibit vegetation growth and favor production of rough fish. Region III impoundments often lack aquatic vegetation (Wilson 2002). Insufficient aquatic vegetation can limit bass production, and subsequently, there are too few bass to control overabundant panfish. Invertebrates, that inhabit vegetation and are an important food source for panfish, are scarce. Shallow, silted-laden waters winterkill more frequently.

Participants identified low productivity as an issue in nearly 50% of our small impoundments (Table 2). This observation was based on the slow growth of fish in these waters. However, Stueven and Stewart (1996) reported trophic state index (TSI) values suggesting hyper-eutrophic to eutrophic conditions in most of these impoundments. TSI values in small impoundments were not substantially different from those of larger natural lakes which support excellent fish growth. Although small impoundments may

have high productivity, it appears to be poorly coupled with the littoral zone which is important to panfish.

Another concern for deeper small impoundments was summer stratification. Anoxic conditions in the hypoliminion can reduce the abundance of macroinvertebrates, an important source of food for panfish and juvenile gamefish. Also, the hypolimnion could act as a "nutrient sink" during summer if nutrients are trapped in the bottom waters, but not available to plants and algae for primary productivity.

Some impoundments (i.e. Tripp, Staum and Wilmarth) are located in remote areas and/or have limited fishing access (i.e. Burbank and Ethan). Use, in these situations, may be limited even with a good fishery.

Table 2. Issues/problems identified for Region III small impoundments. The number in front of the "x" represents the number of participants (4 total) that associated a problem with a specific water. A "?" indicates that the participant was unsure whether or not a problem applied.

Issues/problems	Wilmarth	Ravine	Staum	Henry	Burbank	Ethan	Hanson	Dimock	Menno	Tripp	Iroquois	Alvin	Lakota	McCook	Marindahl	Carthage
Low productivity		3x		1?			2x		1x		2x	3x		4x	1x	
Degraded Habitat		2x		1?		2x	2x	2x			2x	3x		3x,1?		2x
Watershed problems	1x	2x		1?	1?	2x	2x	2x	1x	1x	2x	2x		1x	2x	2x
Lack of vegetation		3x		1?	1?	1x	2x	2x	1x		2x	3x		4x		x
Excessive vegetation	3x		2x	1?	1x,1?					2x			2x			
Stratification problems	2?		1?	1x,1?	1?	1?	2?	2?	2?	1?	1?	3x,1?	1?	3?	1?	?
Overabundant rough fish	1x	3x		2x	1?	2x		2x	2x		3x					2x
Undesirable panfish size structure	2x	2x		1?	1x		2x		3x	1x		4x		3x,1?	3x	2x
LMB recruitment problems	2x			1?	2x	2x	2x	3x	2x	3x		4x		4x	3x	2x
Low use -remote location	2x		2x		1x	1?		1x	2x	2x	1x					
Lack of convenient fishing access	2x	1x			2x	1x	1x				1x			1x,1?		
Shoreline Development		1x					1x							1x		
Winterkill			1x				1x	1x			1x		1x			
Leaky													1x			

Inventory

The Region III SDGFP fisheries staff manages fish communities in 19 small impoundments totaling 1,642 surface acres (Table 1). The majority of small impoundments are managed for largemouth bass (14), bluegill (12), black and white crappies (10) and channel catfish (10). Several impoundments are managed for walleyes (3), northern pike (3) and yellow perch (3). Black bullheads are present in most small impoundments and attempts to control their abundance have been made on several waters.

Indices of population balance constructed from length-frequency distributions have been widely used with midwestern small impoundment fisheries (Ney 1999). The basic index is proportional stock density (Anderson 1978; see Appendix A for a detailed description). The five-cell relative stock density (RSD; Gabelhouse 1984a) index was developed to better assess the size distribution within the quality portion of the population or, in other words, to provide a better description of the fishing opportunity available to anglers. Gabelhouse (1984a) recommended specific ranges of PSD and RSD-P for a balanced panfish or gamefish population.

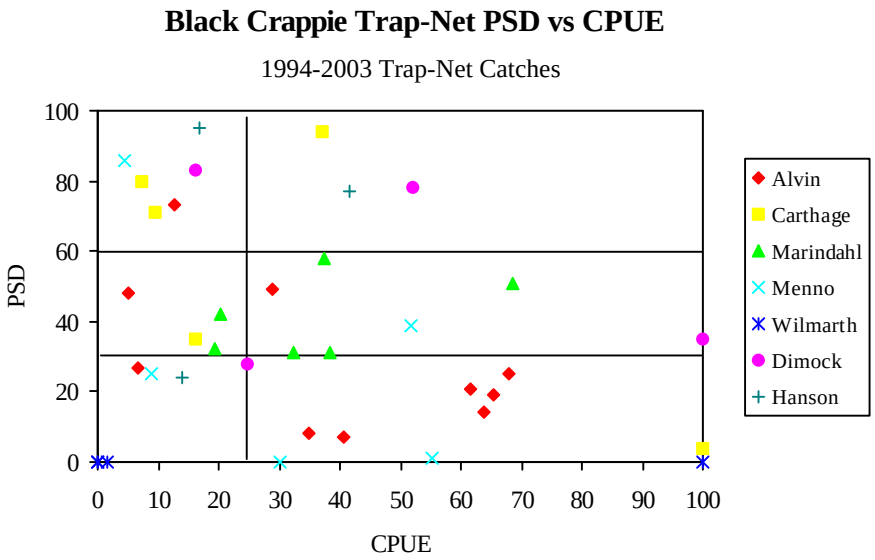
For black crappie in small impoundments, Gabelhouse (1984b) suggested a PSD range of 30-60 and RSD-P of greater than 10. Many of our trap-net samples had a black crappie PSD within the desired range (Figure 1). However, only 3 of 33 trap-net samples had more than 10% of black crappies sampled measuring 10 inches or longer (RSD-P $\geq$ 10; Figure 1). For white crappies, about 22% of the samples had an RSD-P $\geq$ 10 (Figure 2). With both species, there were several cases where larger fish were present, but overall crappie abundance was too low to provide a good fishery.

Anderson (1985) suggested a PSD range of 20-60 and RSD-P of 5-20 for a balanced bluegill population. Once again, most of our trap-net samples contained a high percentage of bluegills longer than 6 inches (PSD $\geq$ 20), but few fish over 8 inches (RSD-P < 5; Figure 3). Only 3 of 39 samples had an RSD-P $\geq$ 5 and a catch per overnight set (CPUE) of over 25. As with crappies, few small impoundments support populations containing larger bluegills that are of interest to anglers.

Several factors suggest that slow growth or high natural mortality of adult panfish, rather than fishing mortality, are responsible for the scarcity of larger fish. First, Bister et al.(2002) showed that slow growth of 8 inch plus crappies in Lake Alvin (Lincoln County) negated any positive effects afforded by a 9-inch minimum size limit (MSL). After reaching 8 inches, Alvin crappies added only 0.2-0.6 inches in length annually taking several years to surpass the 9-inch MSL. Therefore, the regulation was removed to allow anglers to harvest crappies that were “stockpiling” under the MSL (Bister et al. 2002). Slow crappie growth has also been observed in lakes Marindahl, Carthage, McCook and Hanson.

South Dakota impoundment adult crappies experience high natural mortality. No crappies older than age-4 were sampled from Lake Mitchell from 1998-2003. Even with high fishing mortality, we would expect to sample a few older fish. Thus, it appears that Mitchell crappies seldom live longer than 4 years. Guy and Willis (1994) observed a similar truncated age structure with crappies in Lakes Alvin and East Vermillion. They attributed the absence of older fish to fishing mortality, however, subsequent work (Bister et al. 2002) suggested that natural mortality may have a large role in limiting the abundance of older fish.

Growth of small impoundment bluegill adults varies among waters. In Lakes Dimock and Marindahl, growth of bluegills to age-4 is similar to statewide average



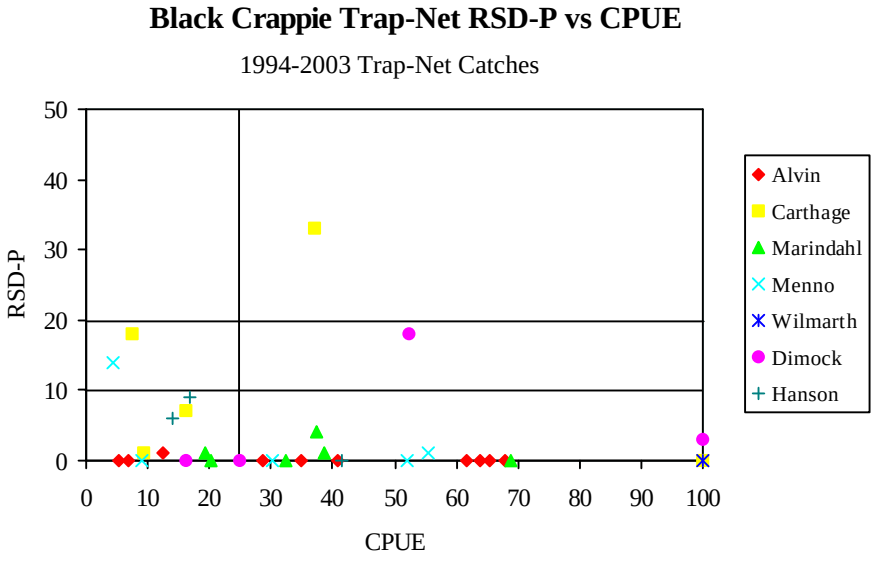
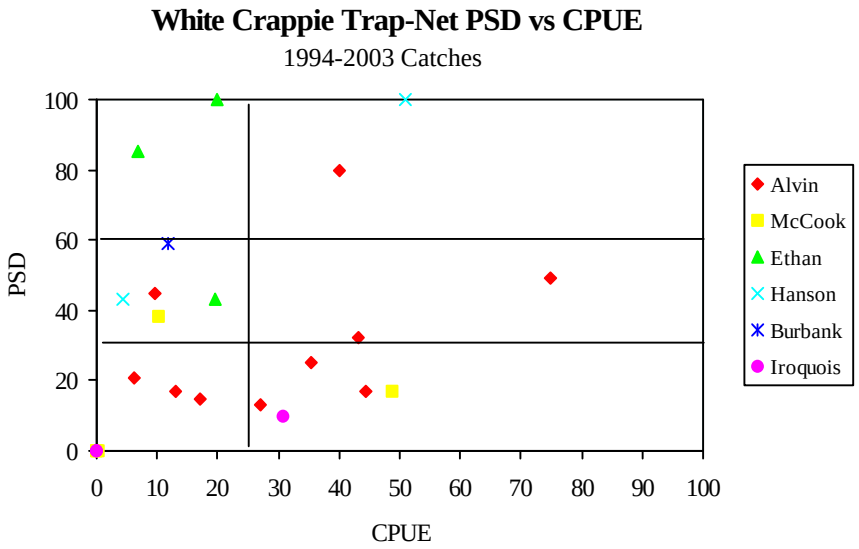


Figure 1. Relationship between relative stock density (RSD-P) or proportional stock density (PSD) and mean catch per overnight set (CPUE) for black crappies captured in trap nets from small impoundments.



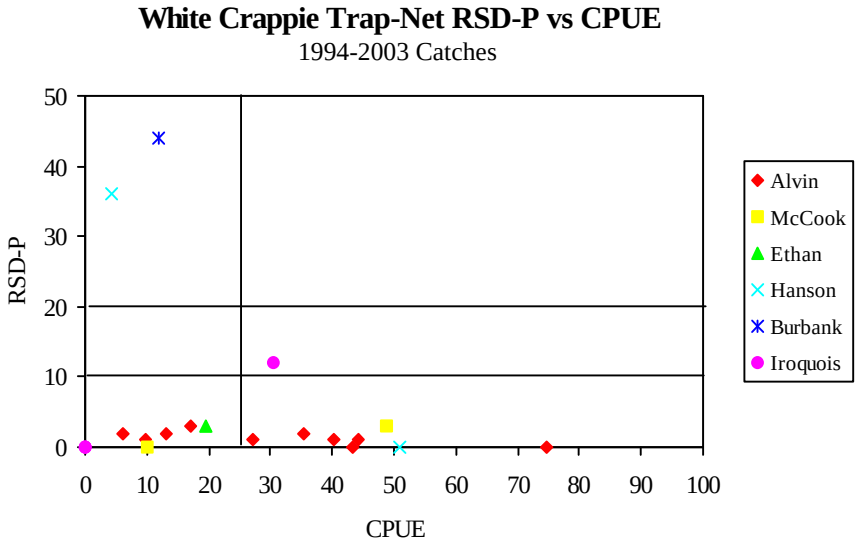
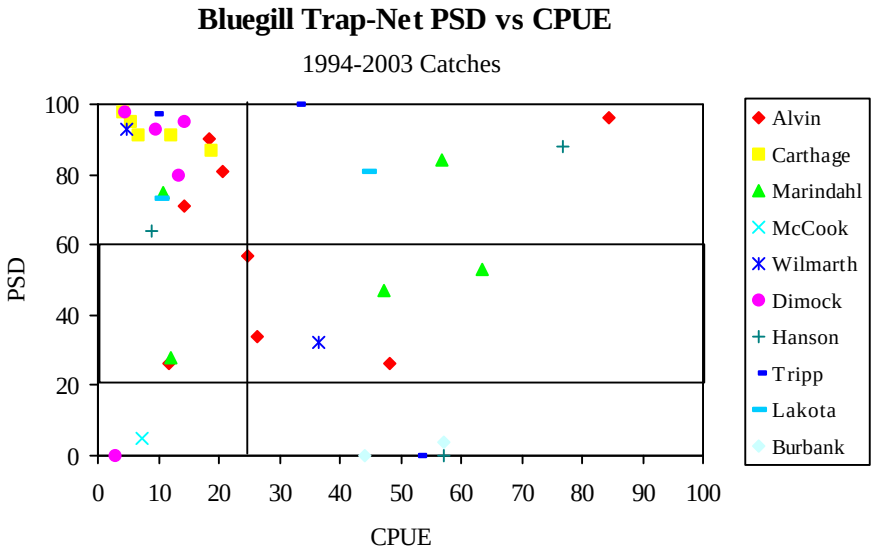


Figure 2. Relationship between relative stock density (RSD-P) or proportional stock density (PSD) and mean catch per overnight set (CPUE) for white crappies captured in trap nets from small impoundments.



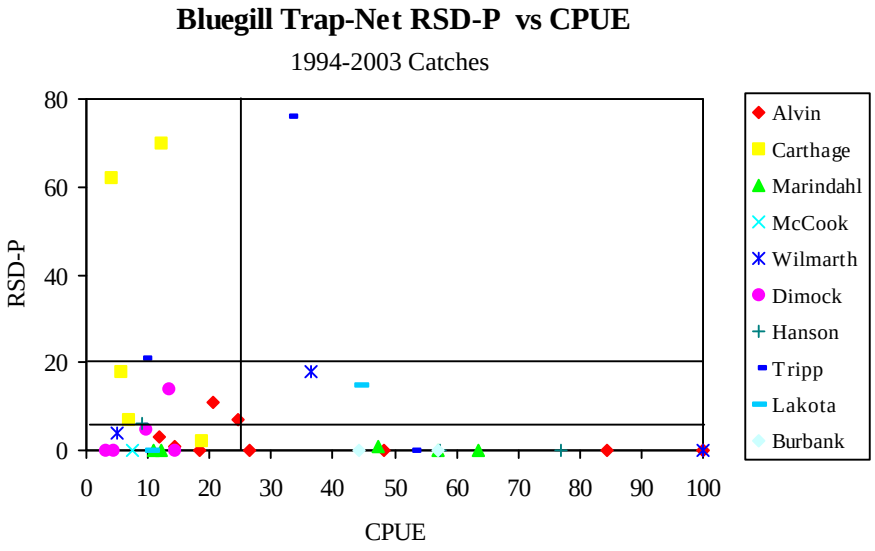


Figure 3. Relationship between relative stock density (RSD-P) or proportional stock density (PSD) and mean catch per overnight set (CPUE) for bluegill captured in trap nets from small impoundments.

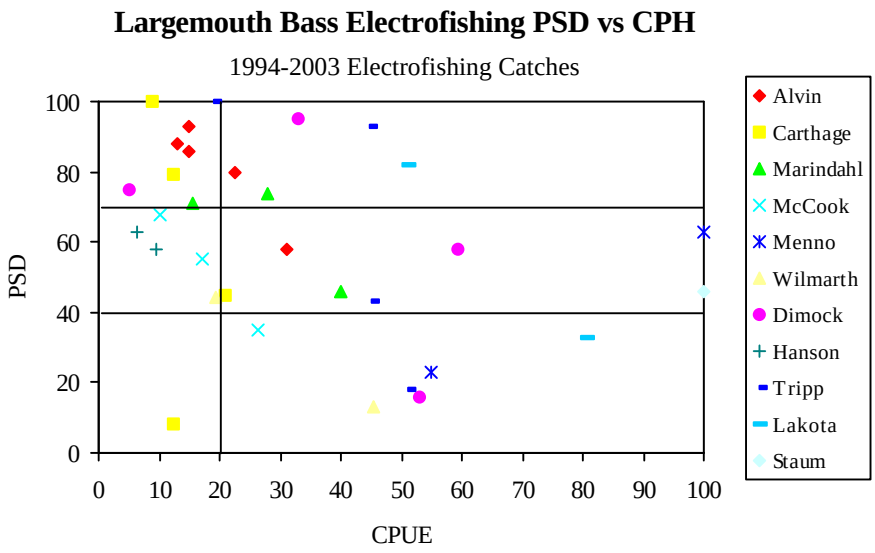
growth. However, growth slows after age-4 (7 inches) and very few bluegills over 8 inches are sampled. Likewise, in Lake Wilmarth, it takes 7-8 years for bluegills to reach 8 inches. Tripp Lake bluegills have the best growth of our small impoundment populations reaching 8 inches in 4 years. South Dakota State University graduate student, Jamie Shepard, is currently studying factors limiting the abundance of larger bluegills on Lakes Marindahl and Alvin.

Unlike crappies and bluegills, largemouth bass grow quickly and attain a large size in our small impoundments. Gabelhouse (1984a) suggested a PSD range of 40-70 and RSD-P range of 10-40 for a balanced largemouth bass population. Most largemouth bass samples, collected by nighttime electrofishing, contain a high percentage of larger individuals and meet or exceed the recommended PSD and RSD-P ranges (Figure 4).

Unfortunately, natural recruitment of largemouth bass is sporadic and often insufficient to maintain high population abundance. For years, fingerling bass (1-2 in) were stocked in an attempt to increase numbers, however, survival was poor and the practice was unsuccessful. Recently, sub-adult and adult bass, captured from slow-growing, over-abundant populations, have been stocked into Region III small impoundments with better success. Stocked adult bass survive well and grow quickly. After adult stockings in Alvin, Marindahl and Tripp, the 2003 and 2004 electrofishing catch-per-hour (CPH) surpassed our objective of 20.

Our small impoundments often contain overabundant black bullhead populations. Trap-net catches often exceed our maximum “acceptable” CPUE of 100 (Figure 5). Growth of abundant black bullheads is commonly slow and few obtain a size desirable to anglers. Small black bullheads compete with panfish and juvenile gamefish for food and could be a factor contributing to poor growth on some waters. On Lake Carthage, bullhead removal with trap nets was successful in significantly reducing numbers and improving size structure. A removal attempt on Lake Menno was not as successful. One of the perceived benefits of stocking adult largemouth bass was to reduce bullhead abundance through predation. So far, increased bass abundance has not resulted in a noticeable reduction in bullhead numbers. Higher predator densities than those produced by our stockings may be necessary for effective bullhead control (Davies 1985; Saffel et al. 1990).

Channel catfish are now found in most of our small impoundments (Figure 5). This spring, adult channel catfish from Angostura Reservoir (Fall River County) were stocked into five small impoundments. Additionally, adult channel catfish taken from Lake Oahe were stocked into Ravine Lake (2003) and Lake Alvin (2004). The objective for adult channel catfish stockings is to provide additional fishing opportunity.



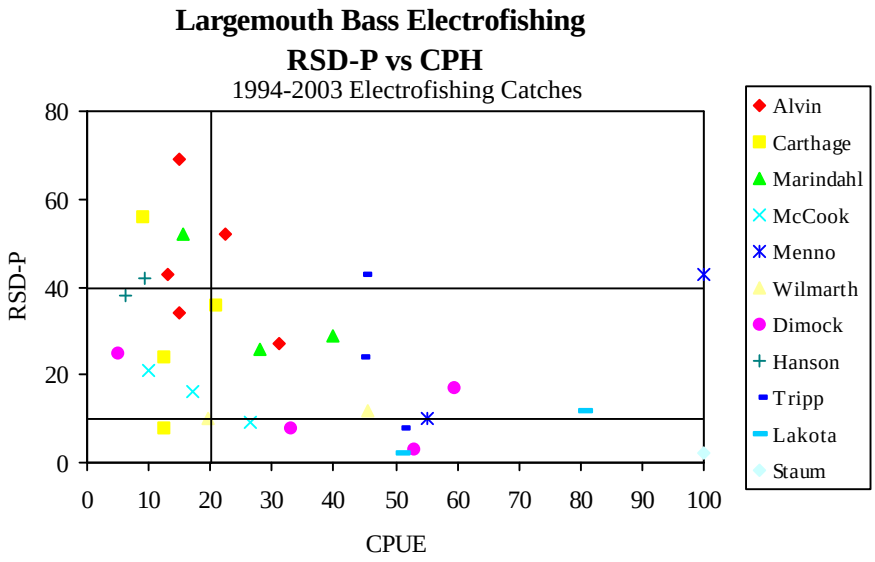


Figure 4. Relationship between relative stock density (RSD-P) or proportional stock density (PSD) and electrofishing mean catch per hour (CPH) of largemouth bass from small impoundments.

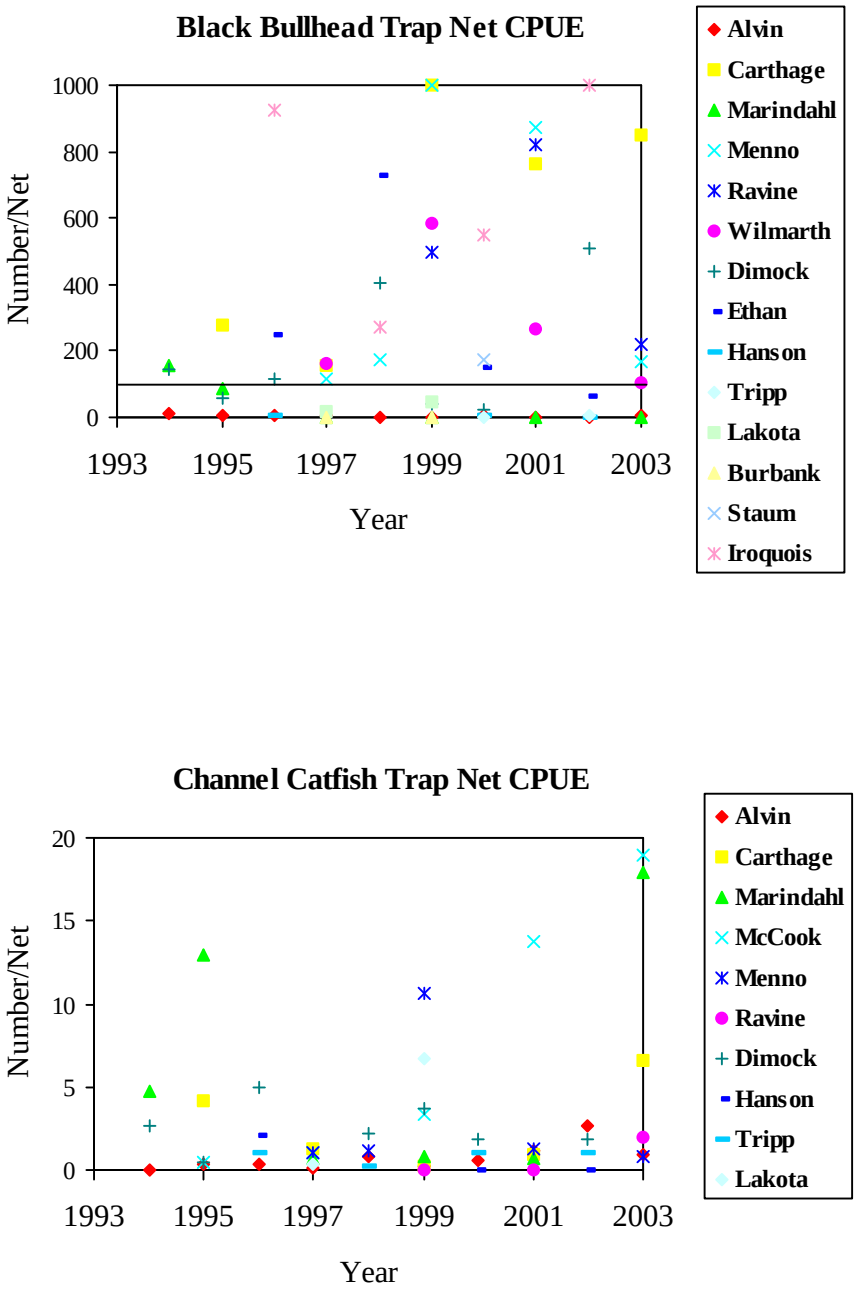


Figure 5. Trap-net catch per overnight set (CPUE) of black bullhead (top) and channel catfish (bottom) from small impoundments, 1994-2003.

Goal: To provide better fishing opportunities and increase angler use and satisfaction on Region III small impoundments.

Objective 1: Increase the percentage of small impoundment survey samples with a crappie trap net CPUE $\geq$ 10 and RSD-P $\geq$ 5 or a bluegill trap net CPUE $\geq$ 20 and RSD-P $\geq$ 5 from 15% to 25% by 2009.

Justification: First, the parameters CPUE and RSD-P can be estimated from scheduled lake surveys, so no additional evaluation procedures will be required.

Dr. Willis (Jan. 31, 2004 e-mail) provided justification for using RSD-P over CPUE-P (CPUE of preferred length fish). CPUE-P is so highly variable with the low amount of effort (net nights) used in standard surveys that significant changes in this parameter would be difficult to measure. RSD-P is based on the number of fish, so that if you get a 100 fish sample, it is relatively easy to detect differences between years.

The crappie objective of CPUE $\geq$ 10 and RSD-P $\geq$ 5 was based on data from our good mid-size impoundment crappie fisheries, Mitchell and East Vermillion. Why not CPUE > 20 or 25 and RSD-P > 10, as discussed last winter? Since 1999, Mitchell crappie catch has exceeded 20/set only once (2001). Likewise, crappie RSD-P exceeded 5 only once (1999). However, from creel data and other reports (petitions, etc.), we know that the lake has provided an excellent crappie fishery in 2002-04.

Survey results were similar for E. Vermillion. One year with CPUE > 20 since 1997 and an RSD-P averaging 17 during this period. Vermillion has provided sporadic good to excellent crappie fishing. The Lake Alvin crappie fishery, when popular back in the late 1980s, still had an RSD-P = 0 (1988 survey), but there were crappies approaching 10 inches.

We had a difficult time setting the bluegill CPUE objective. Once again, Mitchell and recent data from E. Vermillion were used as the standard. The 10-year mean CPUE on Mitchell is almost 21 and the past two years on E. Vermillion were 21 and 41.

Another population that provided a good fishery was Lakota (1997) which had a CPUE of 45 and RSD-P of 15. Surprisingly, the famed Carthage bluegill fishery never met the objective. I checked the data prior to 1994 (88, 91, 93) and found that the population fell short in those years, too. The 1997 and 1998 Lake Alvin bluegill population exceeded the objective. According to creel survey results, bluegill catch and harvest rates peaked in 1996 at 0.42 and 0.13, respectively. That was not a great bluegill fishery.

Strategy 1.1 Reduce crappie and bluegill abundance (and rough fish abundance) by increasing largemouth bass abundance.

Strategy 1.2 Identify small impoundments where black crappies or bluegills grow well and supplement with additional fish from slow-growing populations.

Strategy 1.3 Use aeration to destratify waters like Lake Alvin.

Strategy 1.4 Increase the amount of shoreline habitat by adding tree structures, using enclosures to promote vegetation growth and transplanting native aquatic vegetation.

Strategy 1.5 Mechanically remove rough fish

Strategy 1.6. Continue to pursue opportunities to protect shorelines and watersheds from erosion by providing alternative watering sources or limiting access for livestock and promoting buffer strips for cropland.

Strategy 1.7 Utilize the results of the ongoing bluegill study to develop additional studies and/or modify management strategies.

Objective 2: Increase the percentage of small impoundment survey samples with a largemouth bass electrofishing CPUE $\geq$ 20 from 40% to 60% by 2009.

Justification: With more effective Smith-Root electrofishing gear, the minimum electrofishing CPH representing a good population was raised from 10 to 20. No size structure objectives are needed as growth is typically very good and nearly all our small impoundment bass fisheries contain plenty of larger individuals.

Strategy 2.1 Continue to stock adult largemouth bass to supplement low-density populations.

Strategy 2.2 Develop local sources of juvenile and adult bass for stocking.

Strategy 2.3 Increase the amount of shoreline habitat by adding tree structures, using enclosures to promote vegetation growth and transplanting native aquatic vegetation.

Strategy 2.4 Continue to protect the shoreline and watershed from erosion by locating alternative watering sources or limiting access for livestock and promoting buffer strips for cropland.

Strategy 2.5 Develop hatchery-rearing techniques that successfully produce yearling bass.

Objective 3: Increase the percentage of small impoundment survey samples with a channel catfish trap net CPUE $\geq$ 5 from 12% to 25% by 2009.

Strategy 3.1 Continue to stock adult channel catfish to supplement low-density populations.

Strategy 3.2 Investigate the use of various spawning habitat structures to increase natural reproduction and use them where needed.

Objective 4: Establish populations of other fish species that have potential benefits to the fish communities and fisheries of small impoundments.

Strategy 4.1 Evaluate population dynamics of redear sunfish in private ponds, and if appropriate, introduce them into several small impoundments.

Strategy 4.2 Investigate the potential of flathead catfish to control overabundant populations in small impoundments.

Strategy 4.3 Investigate the use of other potentially beneficial species for introduction into small impoundments.

Objective 5: Increase our knowledge of the productivity of Region III small impoundments and use this information to refine management plans by 2009.

Strategy Participate in an SDSU study to evaluate the effects of destratification by aeration on water quality/productivity in Lake Alvin..

Objective 6: Further quantify angler use of small impoundments and better define demographics and preference of participating anglers by 2009.

Strategy 6.1 Conduct summer creel surveys on a fourth of the SDGFP-managed Region III small impoundments by 2009.

Strategy 6.2 Use information from the 2003 resident fishing activity, harvest and angler opinion survey to help direct management.

Strategy 6.3 Develop a mail survey to specifically poll anglers about their fishing activity, preferences, management issues and to estimate the economic benefit of small impoundment fisheries.

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Appendix A. A brief explanation of catch per unit effort (CPUE), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr).

Catch Per Unit Effort (CPUE) is the catch of animals in numbers or in weight taken by a defined period of effort. Can refer to trap-net nights of effort, gill-net nights of effort, catch per hour of electrofishing, etc.

Proportional Stock Density (PSD) is calculated by the following formula:

$$PSD = \frac{\text{Number of fish} > \text{quality length}}{\text{Number of fish} \geq \text{stock length}} \times 100$$

Relative Stock Density (RSD-P) is calculated by the following formula:

$$RSD\text{-}P = \frac{\text{Number of fish} > \text{preferred length}}{\text{Number of fish} \geq \text{stock length}} \times 100$$

PSD and RSD-P are unitless and usually calculated to the nearest whole digit.

Size categories for selected species found in Region 3 lake surveys, in centimeters.

Species	Stock	Quality	Preferred	Memorable	Trophy
Walleye	25	38	51	63	76
Sauger	20	30	38	51	63
Yellow perch	13	20	25	30	38
Black crappie	13	20	25	30	38
White crappie	13	20	25	30	38
Bluegill	8	15	20	25	30
Largemouth bass	20	30	38	51	63
Smallmouth bass	18	28	35	43	51
Northern pike	35	53	71	86	112
Channel catfish	28	41	61	71	91
Black bullhead	15	23	30	38	46
Common carp	28	41	53	66	84
Bigmouth buffalo	28	41	53	66	84
Smallmouth buffalo	28	41	53	66	84

For most fish, 30-60 or 40-70 are typical objective ranges for "balanced" populations. Values less than the objective range indicate a population dominated by small fish while values greater than the objective range indicate a population comprised mainly of large fish.

Relative weight (Wr) is a condition index that quantifies fish condition (i.e., how much does a fish weigh for its length). A Wr range of 90-100 is a typical objective for most fish species. When mean Wr values are well below 100 for a size group, problems may exist in food and feeding relationships. When mean Wr values are well above 100 for a size group, fish may not be making the best use of available prey.